73rd MORSS CD Cover Page

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Name of Principal Author and all other author(s):   Ian A. McCulloh

Principal Author's Organization and address:

Department of Mathematical Sciences
US Military Academy
646 Swift Road
West Point, NY 10996

Phone: (845) 938-2453

Fax:_ (845) 938-2409

Email: ian.mcculloh@usma.edu

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Presented in (input and Bold one): (**WG 2**, CG___, Special Session ___, Poster, Demo, or Tutorial):

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Computer Simulation of Decontamination Operations

Report Documentation Page

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Outline

➤ Objective Problem

➤ Why Simulation?

➤ System Specification

➤ Experiment and Analysis

➤ MA206 Probability and Statistics

➤ Sensitive Equipment Decontamination

➤ Conclusions

Objective Problem

Minimize Time to Decontaminate a Unit

➢ Eliminate Bottlenecks

➢ Determine Necessary Queue Space

➢ Optimally Allocate Manpower

Arena Simulation

Why Simulation?

➤ Personnel Resources:

➤ Decon Platoon – 24 personnel

➤ Augmentees – 32 personnel

➤ Contamined – 2/veh + Dismounts

500 in simulation

➤ Contamination Simulants

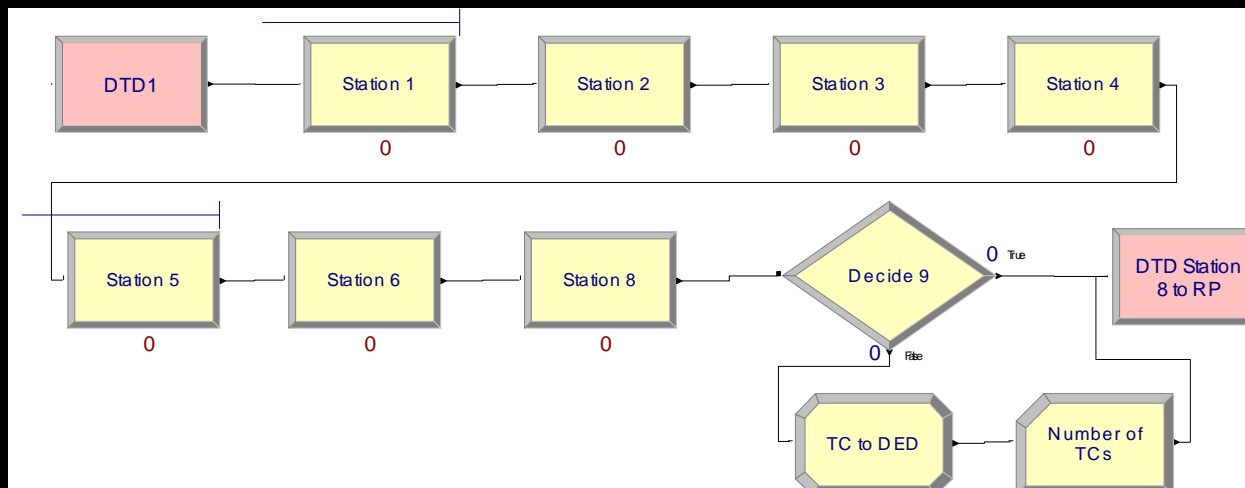➤ Time: How many system layouts? 32+
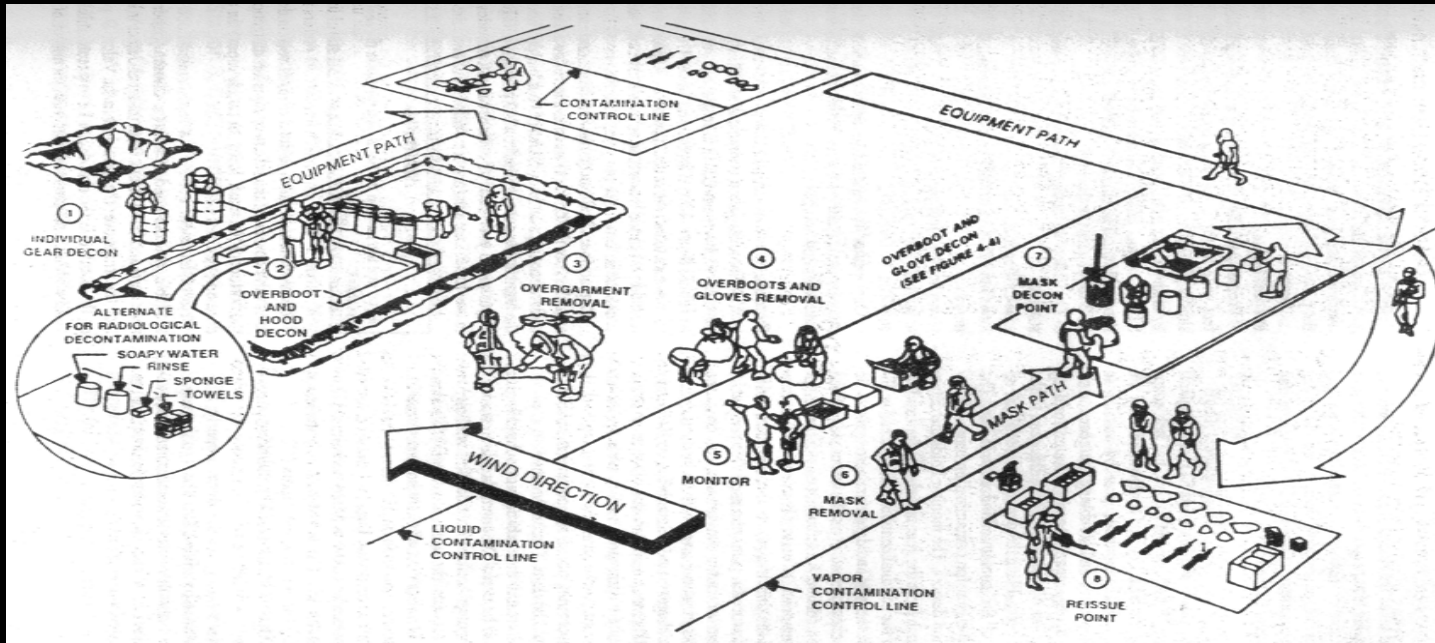
System Specification

Thorough Decontamination

➢ Unit Arrival

➢ DTD (Detailed Troop Decontamination)

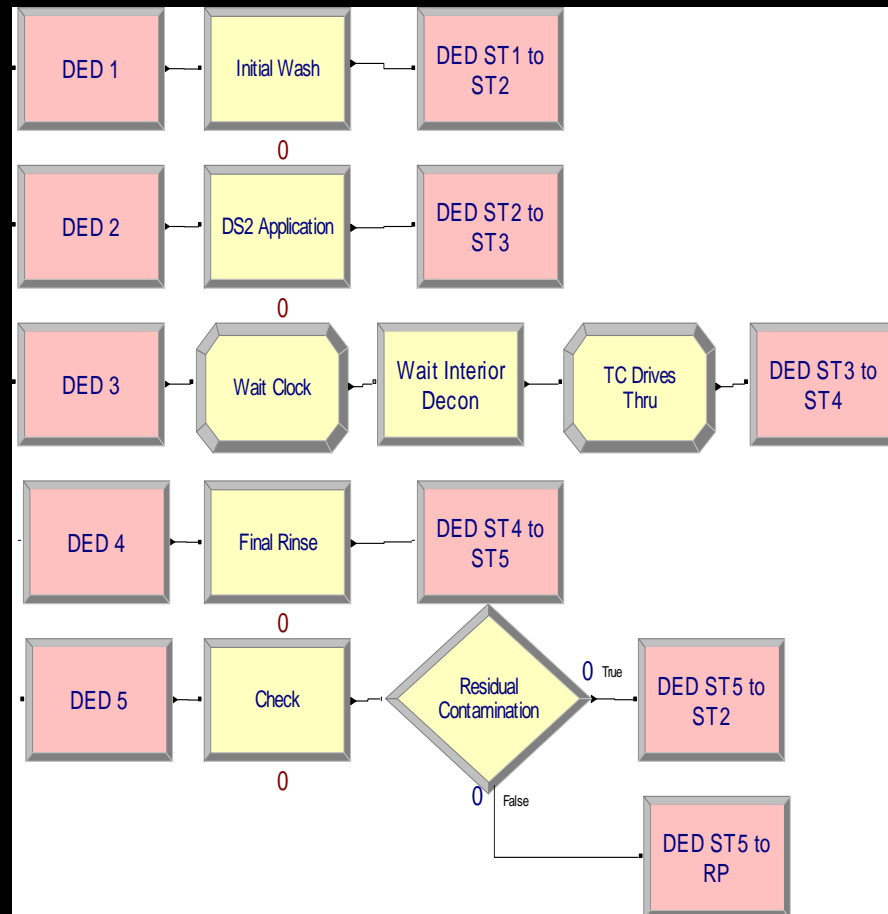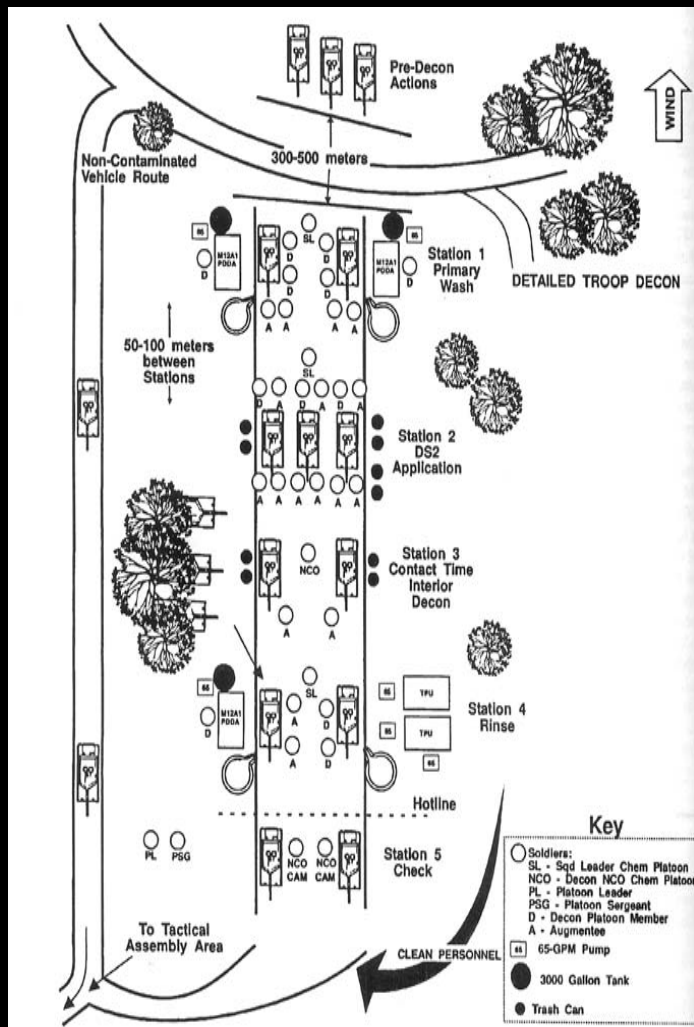➢ DED (Detailed Equipment Decon)

➢ Unit Departure

Data to Build Simulation

➢ Unit Arrival: *National Training Center Rotations CY2002.*

➢ DTD: *Army Test & Evaluation Command (ATEC) DF200 Study Nov 2002.*

➢ DED: *(ATEC) DF200 Study Nov 2002.*

➢ Unit Departure: *No statistical distributions*

Detailed Troop Decon

Detailed Equipment Decon

Unit Arrival

DTD Arrivals

Dismounts Arrive — 0 → Personnel → Soldiers Enter Decon

Operator to DTD — 0 → Operator Begins → DTD SP to ST1

Crew Dismounts — 0 → Crew Begins

DED Arrivals

Tanks Arrive — 0 → Tank Assign → Vehicles Enter Decon

Trucks Arrive — 0 → Truck Assign → DED SP to ST1

HMMWV Arrive — 0 → HMMWV Assign
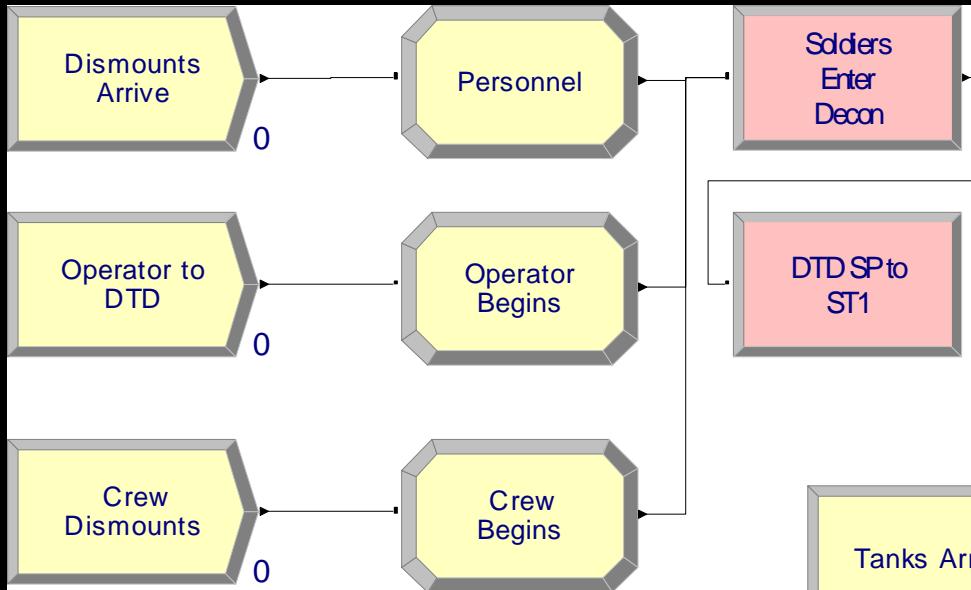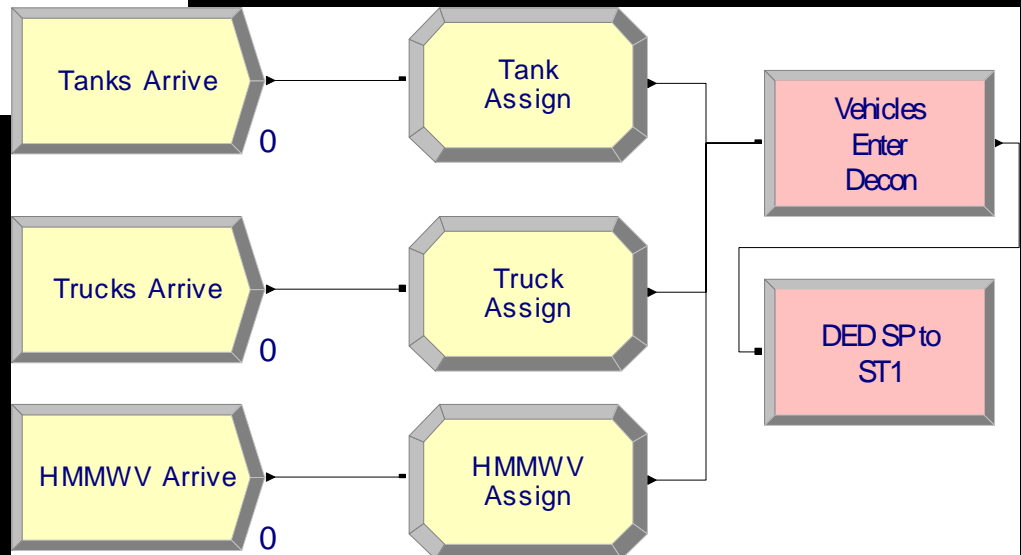
Verification and Validation

Validation

➤ Not Against NTC Data

➤ Not Against ATEC Data

➤ Faster Than Army Doctrine Standards

By Same Difference as in DED 2

Experiment and Analysis

Five Factors

➢ Manpower Augmentees on DED

  DED 1, DED 2, and DED 4

➢ Priority to Licensed Drivers
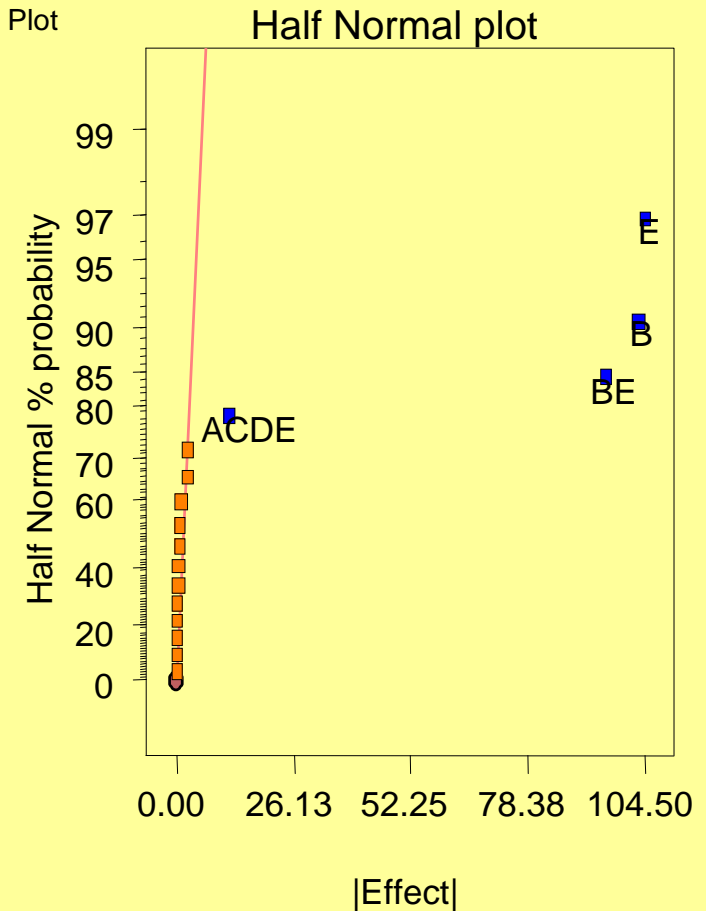
➢ DTD Time of 0 Minutes

Response: Time in System, Wait Time

Experiment and Analysis

- 2$^{5-1}$ Design
- Resolution V
- 100 Duplicates
- Factors Ordered in
  Most Likely Effect
- B, E, and BE significant

DESIGN-EXPERT Plot
Average TIS

A: DED 2 Aug
B: TC Priority
C: DED 4 Aug
D: DED 1 Aug
E: DTD Speed

Half Normal plot

Half Normal % probability

99
97
95
90
85
80
70
60
40
20
0

E
B
BE
ACDE

0.00   26.13   52.25   78.38   104.50

|Effect|

Experiment and Analysis

DESIGN-EXPERT Plot

Average TIS

X = B: TC Priority
Y = E: DTD Speed

● Design Points

■ E- -1.000
▲ E+ 1.000

Actual Factors
A: DED 2 Aug = 6.00
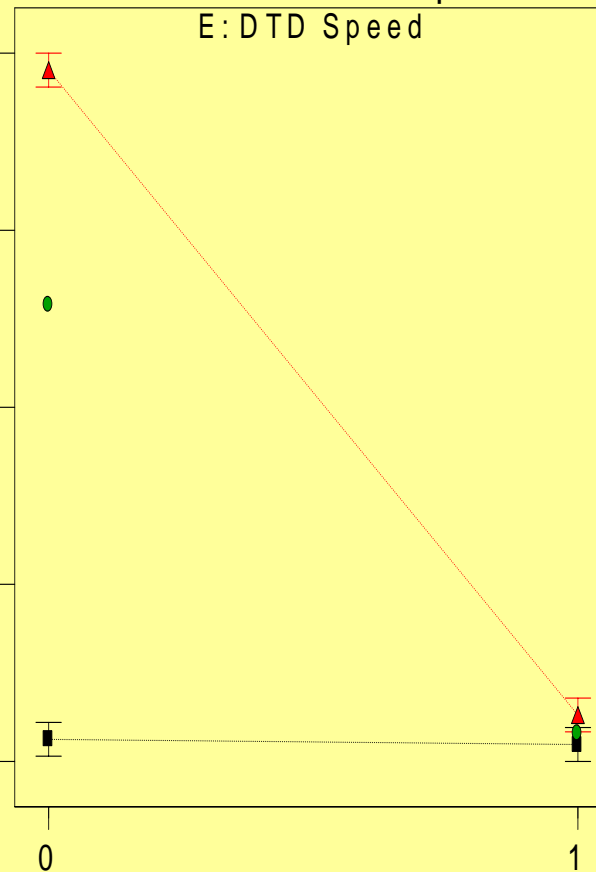C: DED 4 Aug = 1.50
D: DED 1 Aug = 3.00

Interaction Graph

E: DTD Speed

443.01

390.049

337.087

284.126

231.165

STISaverage

0   1

B: TC Priority

Findings

Reduce DTD Time

> ➤ Prioritize Licensed Drivers

> ➤ Use a Faster DTD Method

> ➤ Have Contaminated Unit Provide
>
> Extra Clean Drivers

Queue Size at DED 3 = 3 Tanks,
5 5-ton Trucks, and 5 HMMWVs

MA 206 Project #1

Sophomore project in 4th core math course

Differences

- ➤ Simplified (No queuing model)
- ➤ Just the DED (No Arrival/Depart/DTD)
- ➤ Modified Distributions
- ➤ No Experimental Design & Analysis
- ➤ Monte Carlo v. Discrete Event Sim.

Writing Contest: Winner accepted for publication in JUSE.

Sensitive Equipment Decon

Decontamination of radios, NVG, digital

Three Technologies:

- ➢ 1 Item at a time: (dishwasher size) 15 min.
- ➢ Platoon's Items: (conex size) 6+ hours
- ➢ Decon Fog: size and time not determined

Must consider personnel and maint. req.

Live Experiment: 6-17 June 2005

Improve Simulation with LTC Novikov's

Thesis 1993.

Conclusions

➢ Simulation is an efficient means to evaluate proposed decontamination processes.

➢ Personnel decontamination is the most time consuming task, made even more difficult with SED.

➢ Solutions require creativity, analysis, and validation.